AMENDMENTS TO THE SPECIFICATION

Please **revise the paragraph beginning on page 7, line 13 of the original specification** as follows:

The invention will now be described by way of non-limiting embodiments with reference to the accompanying drawings in which

- Fig. 1 is a schematic picture of a chemical heat pump,

- Fig. 2a is a cross-sectional view of an integrated heat exchanger/substance unit,

- Fig. 2b ~~is a perspective view of a self-supporting accumulator having a plurality of heat exchanger/substance units~~ is a view in a larger scale of a segment of the heat exchanger/substance unit of Fig. 2a,

- Fig. 2c is a perspective view of a self-supporting accumulator having a plurality of heat exchanger/substance units,

- Fig. 3a is a schematic cross-sectional view of a chemical heat pump having an accumulator and an evaporator/condenser in the same circular enclosure or housing,

- Fig. 3b is a schematic cross-sectional view of a circular substance unit,

- Fig. 3c is a perspective view of a portion of a circular substance unit,

- Fig. 3d is a view of a detail of a circular substance unit,

- Fig. 4 is a schematic picture of a chemical heat pump as part of an air-conditioning system,

- Fig. 5 is a cross-sectional view of a chemical heat pump used as a cooling element in a refrigerating box, and

- Fig. 6 is a diagram showing vapour pressures of water and of a metal salt as functions of temperature.

Please **revise the paragraph beginning on page 8, line 11 of the original specification** as follows:

In a preferred embodiment of an integrated heat exchanger unit for carrying the active substance which can be suitably used as the heat exchanger 7 in Fig. 1 and for which unit a cross-sectional view is shown in Fig. 2a, the heat flow and the gas flow <u>(See arrows 21' and 21" respectively, in the detail view of Fig. 2b)</u> are directed perpendicularly to the large exterior surfaces 21 and 21a of the heat exchanger. The whole, contiguous parallel surfaces 21, 21a which belong to the heat exchanger and are non-permeable to gas and heat exchanger medium and are of for example metal plate are interconnected by a structure such as a crossbar work having channels 22 for an exterior heat exchanger medium through which the heat exchanger medium passes in parallel to the large surfaces. At least on one surface 21 of the heat exchanger a heat transport enhancing structure 25 of metal or other suitable heat conducting material is applied.

Please **revise the paragraph beginning on page 9, line 13 of the original specification** as follows:

In a preferred embodiment a substance structure 23 and a gas channel structure 27 are arranged on the two opposite large surfaces 21 and 21a of the heat exchanger in order to form a

double heat exchanger/substance structure having a solid substance at its two large surfaces. Such double heat exchanger/substance structures can be placed at each other to form a package, see ~~Fig. 2b~~ Fig. 2c, having an exterior tight enclosure of for example thin metal plate, not shown. When the interior of the enclosure is then connected to a vacuum, because of the air pressure the walls of the enclosure will compress the heat exchanger/substance structures located therein, in particular in the x-direction, provided that the heat transport enhancing structure 25 is not completely rigid but can yield a little. It is used in the drying process and the final formation of the substance layer 3. The accumulator becomes self-supporting in x-, y- and z-directions at the same times as advantageous properties of the transport of heat and gas are obtained by the final formation.

Please **revise the paragraph beginning on page 14, line 28 of the original specification** as follows:

Example 1a. 598 g barium hydroxide (octahydrate) having a purity of 98 %, quality "Puriss", was mixed with 194 g water, i.e. 5.7 moles H_2O per mole $Ba(OH)_2{\bullet}8H_2O$, so that a semi-liquid or thickly flowing mass, a slurry, was obtained. This means a concentration of 5.7 moles above the most hydrated state of the salt. The mass will thus only be liquified when being stirred or vibrated. It was at ambient temperature applied to an heat exchanger surface of the type shown in ~~Fig. 2~~ Figs. 2a-2c during a simultaneous vibration obtained from a vibrator which was the same type as being used in moulding concrete but having smaller dimensions and which was held in contact with the heat exchanger. The vibrations had a frequency of 25 to 50

Hz. Then, the substance flew easily and was deposited in the interspaces in the heat exchanger structure. A thin meal plate enclosure was applied around the heat exchanger and it was connected to a vacuum pump. This was allowed to pump air and water away during a simultaneous heating. Typical data was that the pumping was made down to the equilibrium vapour pressure of the substance of about 20 mm Hg at 20°C for about 240 minutes with a smooth temperature increase from ambient temperature to 80°C when the pumping away was finished. The tight plate enclosure was removed. The mass was found to be well sintered together and to be rigidly attached to the surface of the heat exchanger. A part of the mass was taken out which was found to contain hydroxide having the formula $Ba(OH)_2$•$1.5H_2O$. The density of the mass was determined to be 861 g/l, which is significantly larger than the density of the correspondingly dryly packed substance, which for this amount of water of crystallization is 619 g/l, see Example 1b. In spite of the high degree of packing as proved by the measured density of 81 g/l the porosity is good. The density of crystalline $Ba(OH)_2$•$1.5H_2O$ is 1.37 g/l, and thus the remaining porosity still constitutes 36% of the volume. The heat exchanger including the attached substance was then allowed to execute 10 cycles including absorption of water and heating to 80°C for eliminating water, placed in a heat pump according to Fig. 1. The mass appeared to have no signs of being detached from the surface of the heat exchanger - no cracks or cavities were produced at this surface in the substance. The mass absorbed and emitted water without reductions of the reaction speed as time passed according to the following: completely charged after 4 hours, completely discharged after 30 hours. The reaction

speed was maintained without any noticeable change for all of the cycles. The effective value of the energy content was measured to be 0.32 kWh/l.

Please **revise the paragraph beginning on page 15, line 20 of the original specification** as follows:

Example 1b. 430 g barium hydroxide (octahydrate) having a purity of 98%, quality "Puriss", was ground to a fine grain powder and was screened through steel cloth of 300 mesh. The screened powder was applied at ambient temperature when being vibrated, in the same way as in Example 1a, to the surface of the heat exchanger according to ~~Fig. 2~~ Figs. 2a-2c. Then the substance was applied in the interspaces in the heat exchanger structure. The substance was sintered by drying and heating to a mass in the same way as in Example 1a. The mass was thereupon found to be well sintered together and be rigidly attached to the surface of the heat exchanger. A part of the mass was taken out which was found to contain hydroxide having the formula $Ba(OH)_2 \bullet 1.5H_2O$. The density of the mass was determined to be 619 g/l which gives a porosity of 50% of the volume of crystalline $Ba(OH)_2 \bullet 1.5H_2O$. The heat exchanger including the attached substance was then made to execute 10 cycles including absorption of water and heating to 80°C for eliminating water, placed in a heat pump according to Fig. 1. The mass appeared to have indications of being detached from the surface of the heat exchanger. The mass absorbed and emitted water without reduction of the reaction speed but the time for obtaining a complete charging was now prolonged to 6 hours. The time up to a complete

discharge was 30 - 40 hours. The reaction speed was maintained without any noticeable change for all the cycles. The effective value of the energy content was measured to be 0.23 kWh/l.

Please **revise the paragraph beginning on page 15, line 38 of the original specification** as follows:

Example 2a. 670 g $CoCl_2$•$6H_2O$ having a purity of 99% and a quality "pro analysi" was mixed with 127 g water, i.e. 1.75 moles H_2O per mole $CoCl_2$•$6H_2O$, so that a semi-liquid or thickly flowing mass, a slurry, was obtained. This means a concentration of 1.75 moles above the most hydrated state of the salt. The mass was applied at ambient temperature when being vibrated, in the same way as in Example 1a, to the heat exchanger surface according to ~~Fig. 2~~ <u>Figs. 2a-2c</u>. Then the substance became easily flowing and was deposited in the interspaces in the heat exchanger structure. The substance was sintered by drying and heating to a solid mass in the same way as in Example 1a. The mass was thereafter found to be well sintered together and to be rigidly attached to the surface of the heat exchanger. A part of the mass was taken out which was found to contain hydrated salt having the formula $CoCl_2$•$2H_2O$. The density of the solid mass was measured to be 900 g/l, which is larger than the density 635 g/l of the corresponding dryly packed substance, see Example 2b. The mass has a porosity of 33% compared to the crystalline form of the corresponding hydrate which has a density of 1.34. The heat exchanger including the attached substance was then made to execute 10 cycles including absorption of water and heating to 80°C for eliminating water when it was placed in a heat pump according to Fig. 1. The mass had no indications of being detached from the surface of

the heat exchanger. The mass absorbed and emitted (desorbed) water without any reduction of reaction speed. The effective value of the energy content was measured to be 0.25 kWh/l.

Please **revise the paragraph beginning on page 16, line 18 of the original specification** as follows:

Example 2b. 473 g $CoCl_2 \cdot 6H_2O$ (hexahydrate) having a purity of 99% and of quality "pro analysi" was ground to a fine grain powder and was screened through a steel cloth of 300 mesh. The screened powder was applied at ambient temperature when being vibrated, in the same way as in Example 1a, to the surface of the heat exchanger according to ~~Fig. 2~~ Figs. 2a-2c. Then the substance was deposited in the interspaces in the heat exchanger structure. The substance was sintered by drying and heating to a solid mass in the same way as in Example 1a. The mass was then found to be well sintered together and to be rigidly attached to the surface of the heat exchanger. A part of the mass was taken out which was found to contain hydrated salt having the formula $CoCl_2 \cdot 2H_2O$. The density of the solid mass was measured to be 635 g/l. The mass has a porosity of 33% compared to the crystalline form of the corresponding hydrate which has a density of 1.34. The heat exchanger including the attached substance was then made to perform 10 cycles including absorption of water and heating to 80°C for removing water when it was placed in a heat pump according to Fig. 1. The mass proved to have indications of being detached from the surface of the heat exchanger. The mass absorbed and emitted water without any reduction of the reaction speed. The effective value of the energy content was measured to be 0.21 kWh/l.

Please **revise the paragraph beginning on page 16, line 35 of the original specification** as follows:

Example 3a. 302 g LiH•0.65H_2O having a purity of 98% and of quality "purum" was mixed with 167 g water, which corresponds to 1.1 moles H_2O above the most hydrated state of the salt, so that a semi-liquid or thickly flowing mass, a slurry, was obtained. The mass was applied at ambient temperature when being vibrated, in the same way as in Example 1a, to the surface of the heat exchanger according to ~~Fig. 2~~ Figs. 2a-2c. Then the substance became easily flowing and was deposited in the interspaces in the heat exchanger structure. The substance was sintered by drying and heating to a solid mass in the same way as in Example 1a. The mass was then found to be well sintered together and to be rigidly attached to the surface of the heat exchanger. A part of the mass was taken out which was found to contain the salt LiOH without any water of crystallization. The density of the solid mass was measured to be 513 g/l which is larger than the density 487 g/l of the correspondingly dryly packed substance, see Example 3b. The mass then has a volume porosity of 67% compared to the crystalline form of the salt, which has a density of 1.46. The heat exchanger including the attached substance was then made to execute 10 cycles including absorption of water and heating to 80°C for emitting water when it was placed in a heat pump according to Fig. 1. The time for a complete charging process amounted to 4 hours whereas a complete discharging lasted 24 hours. The mass proved to have no indications of being detached from the surface of the heat exchanger. The mass absorbed and

emitted water without any reductions of the reaction speed. The effective value of the energy content was measured to be 0.16 kWh/l.

Please **revise the paragraph beginning on page 17, line 15 of the original specification** as follows:

Example 3b. 287 g LiH•0.65H_2O having a purity of 98% and of quality "purum" was ground to a fine grain powder and was screened through a steel cloth of 300 mesh. The screened powder was applied at ambient temperature when being vibrated, in the same way as in Example 1a, to the surface of the heat exchanger according to ~~Fig. 2~~ Figs 2a-2c. Then the substance was deposited in the interspaces in the heat exchanger structure. The substance was sintered by drying and heating to a solid mass in the same way as in Example 1a. The mass was then found to be well sintered together and be rigidly attached to the surface of the heat exchanger. A part of the mass was taken out which was found to contain the salt LiOH having no water of crystallization. The density of the solid mass was measured to be 487 g/l, which corresponds to a volume porosity of 71% compared to the crystalline form of the salt. The heat exchanger including the attached substance was then made to perform 10 cycles including absorption of water and heating to 80°C for removing water when it was placed in a heat pump according to Fig. 1. The time for a complete charging process comprised like the salt applied in a slurry shape 4 hours whereas the time for complete discharging was increased to 27 hours. The mass proved to have very weak indications of being detached from the surface of the heat

exchanger. The mass absorbed and emitted water without any reduction of reduction speed. The effective value of the energy content was measured to be 0.15 kWh/l.

Please **revise the paragraph beginning on page 17, line 33 of the original specification** as follows:

Example 4a. 883 g $SrBr_2 \cdot 6H_2O$ having a purity of 99% and of quality "puriss.p.a." was mixed with 132 g water which corresponds to 2.48 moles H_2O above the most hydrated state of the salt so that a semi-liquid or thickly flowing mass, a slurry, was obtained. The mass was applied at ambient temperature when being vibrated, in the same way as in Example 1a, to the surface of the heat exchanger according to ~~Fig. 2~~ Figs. 2a-2c. Then the substance became easily flowing and was deposited in the interspaces in the heat exchanger structure. The substance was sintered by drying and heating to a solid mass in the same way as in Example 1a. The mass was then found to be well sintered together and be rigidly attached to the surface of the heat exchanger. A part of the mass was taken out which was found to contain the hydrated salt $SrBr_2 \cdot H_2O$. The density of the solid mass was measured to be 1492 g/l which is larger than the density 1044 g/l of the corresponding dryly packed substance, see Example 4b. The mass then has a volume porosity of 17% compared to the crystalline form of the salt which has a density of 1.79. The heat exchanger including the attached substance was then made to perform 10 cycles including absorption of water and heating to 80°C for emitting water when it was placed in a heat pump according to Fig. 1. The time for a complete charging process comprised 4 hours whereas a complete discharging lasted 16 hours. The mass proved to have no indications of

being detached from the surface of the heat exchanger. The mass absorbed and desorbed water without any reduction of the reaction speed. The effective value of the energy content was measured to be 0.32 kWh/l.

Please **revise the paragraph beginning on page 18, line 13 of the original specification** as follows:

Example 4b. 618 g $SrBr_2•6H_2O$ having a purity of 99% and of quality "puriss.p.a." was ground to a fine grain powder and was screened through a steel cloth of 300 mesh. The screened powder was at ambient temperature when being vibrated applied in the same way as in Example 1a to the surface of the heat exchanger according to ~~Fig. 2~~ <u>Figs. 2a-2c</u>. Then the substance was deposited in the interspaces in the heat exchanger structure. The substance was sintered by drying and heating to a solid mass in the same way as in Example 1a. The mass was then found to be well sintered together and rigidly attached to the surface of the heat exchanger. A part of the mass was taken out which was found to contain the hydrated salt $SrBr_2•H_2O$. The density of the solid mass was measured to be 1044 g/l which corresponds to a volume porosity of 24% compared to the crystalline form of the salt. The heat exchanger including the attached substance was then made to perform 10 cycles including absorption of water and heating to 80°C for removing (desorbing) water when it was placed in a heat pump according to Fig. 1. The time for a complete charging comprised 4 hours whereas the time for complete discharging was prolonged to 20 hours. The mass appeared to have indications of being detached from the

surface of the heat exchanger. The mass absorbed and emitted water without any reduction of the reaction speed. The effective value of the energy content was measured to be 0.23 kWh/l.

Please **revise the paragraph beginning on page 18, line 39 of the original specification** as follows:

In the application for solar driven air conditioning the reactor part and the condenser/evaporator part can suitably be located inside the same physical space or enclosure, see the schematic cross-sectional view of Fig. 3a. The parts can also have a circular or cylindrical geometry or symmetry even though some advantages of the flat structure according to Figs. 2a ~~and 2b~~ <u>and 2c</u> cannot be obtained. Thus, a common tank 31 encloses all of the system so that a complete hermetic, evacuated chemical heat pump is obtained therein. The tank 31 is internally partitioned in two separate departments. A first upper department 32 accommodates the accumulator and constitutes the reactor and in a second department 33 located thereunder the condenser/evaporator is provided. In the accumulator part 32 a heat exchanger 34 is placed concentrically along the interior circumference of the tank 31. The heat exchanger 34 can be single or as is illustrated in Fig. 3a consist of a plurality of concentric units 34a, 34b as seen from the centre of the tank so that each unit has the shape of a cylinder ring. Each unit in the heat exchanger 34 is flange type and comprises vertically standing lamellae 35, see Fig. 3b, which thus are located in planes extending through the axis of the cylindrical shape and are mounted in a fan shape on the heat carrier 36 of the heat exchanger, see the perspective view of Fig. 3c. These heat carriers 36 are constituted of horizontal loops of piping which are

coupled in parallel to each other and form circular pipe loops also having the same axis as the other parts of the heat pump. Around the heat exchanger units or packages 34 nets 37 are stretched on both the exterior side and the interior side and over the bottom thereof. Between the net walls 37 the substance 38 has been filled. Furthermore, it is assumed that substance 38 moulded between the lamellae 35 has a free gas flow into it and away from it, respectively, through channels 45 parallel to the lamellae, see Fig. 3d.